January 20, 2016
Project No. 9101110001

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Arizona Department of Environmental Quality
1110 West Washington Street, 4415B-1
Phoenix, Arizona 85007

Subject: Response to WAFB – ADEQ Comments
ST012 SEE Weekly Progress Reports
Oct. through week ending November 9, 2015
Former Fuel Storage Area (ST012)
Former Williams Air Force Base
Mesa, Arizona

On the behalf of the U.S. Air Force, Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) and TerraTherm, Inc. (TerraTherm) are transmitting responses to the Arizona Department of Environmental Quality (ADEQ) comments dated 19 November 2015. The ADEQ comments are repeated below along with responses.

General Comments

1. The criteria for transitioning from SEE to EBR are provided in Table 4-2 of the May 2014 Work Plan. Two primary criteria are diminishing mass extraction rates (less than 10% of peak rates during SEE) and benzene groundwater concentrations less than 500 µg/L. To date, neither of these criteria has been demonstrated nor have results indicated achieving these criteria in the near future. Until further progress is demonstrated, EBR transition discussion may be premature.

***Response**: The two primary criteria identified in the RD/RAWP in the paragraph before Table 4-2 are achieving target subsurface temperatures and diminishing mass removal rates. The criterion for benzene concentrations is secondary to the other two. The data presented during the 23 November 2015 BCT call demonstrate meeting the primary criteria of temperature and mass removal targets as defined in the RD/RAWP although recent data received since the BCT call has indicated the mass removal rate is above the target. Benzene concentrations less than 500 µg/L have been demonstrated only at some locations; however, as presented in Table 4-2 of the RD/RAWP and during the November BCT call, achievement of this criterion may be inhibited by the contribution of contamination from outside the TTZs. Amec Foster Wheeler, TerraTherm, and the Air Force believe that ongoing discussions of SEE/EBR transition have been beneficial within the BCT to understand remedial progress and status. Based on consideration of all remedial progress measurements, the Air Force has agreed that continued steam injection remains appropriate through the month of February, based on current site conditions. Although some of the preliminary transition dates presented have proven premature, the discussion of transition criteria status and potential transition dates is necessary and appropriate for the evaluation of site remedial status.*

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Specific Comments
Comments on Recent Weekly Progress Reports through November 12, 2015. Comments are stated, identified by report time frame, and followed by report excerpts and comment context explanations.

Section 4. Mass Removal

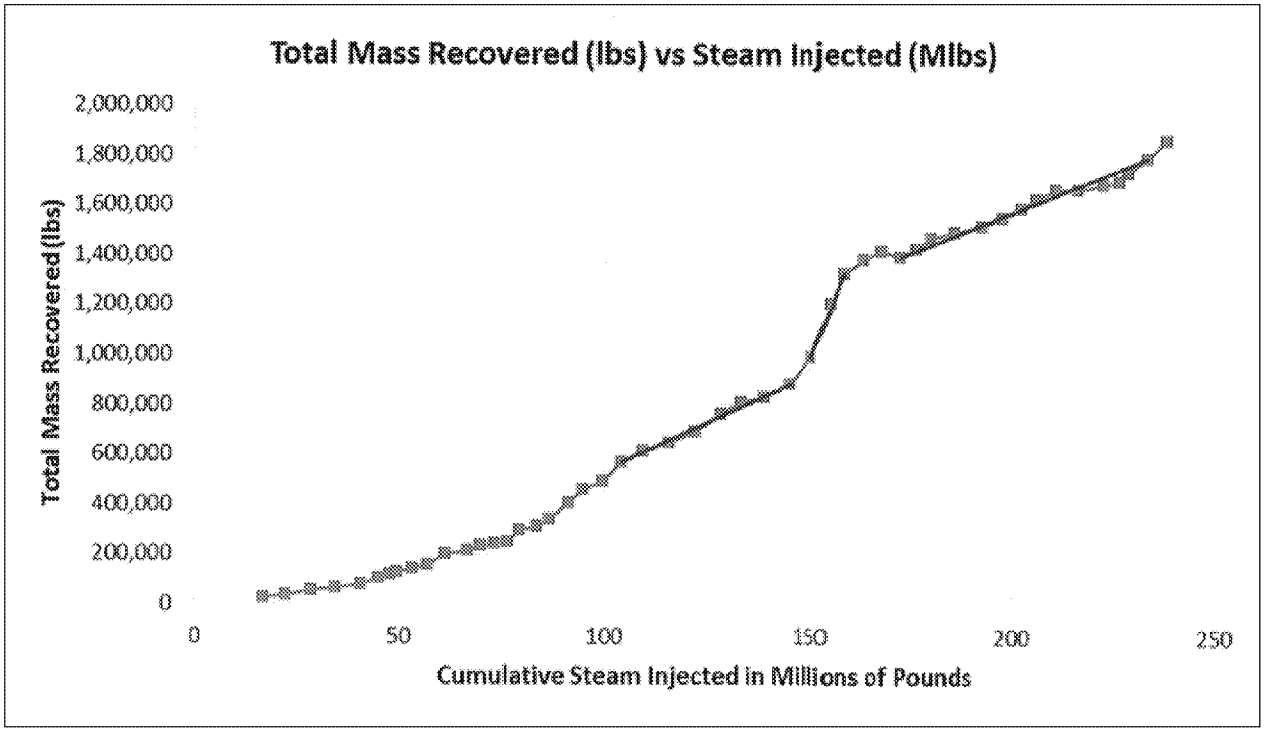
1. The inability to assess mass removal from individual treatment intervals (CZ, UWBZ, LSZ) hampers performance evaluation. (Oct. 2015).
2. The data do not indicate a significant decay in recovery rate after breakthrough. (Oct. 2015)
3. Clarify mass removal rate (Nov. 2015).
4. Verify benzene feedwater concentration (Nov. 2015).

From Oct. 2015 reports (comments 1 and 2):

The cumulative mass removal plotted in Figure 3 shows an inflection point for a decrease in the rate of mass recovery around June 20 coinciding with the initiation of de-pressurization in the LSZ. The inability to assess mass removal from individual treatment intervals (CZ, UWBZ, LSZ) hampers the evaluation of performance.

***Response**: As presented in the RAWP, the basis of design for the SEE system did not include the capability to assess mass removal from individual treatment intervals (CZ, UWBZ, LSZ). The system performance is measured by data collected through the process based on a combined process stream from all three treatment intervals. TerraTherm and Amec Foster Wheeler have been collecting jar samples from each of the MPE wells since 23 October 2015 to provide an indirect indicator of the locations and zones where NAPL is produced. The collected data are presented in the weekly operational progress reports.*

The total mass recovery is plotted below as a function of cumulative steam injected instead of date. Steam breakthrough in a number of wells may coincide with the jump in mass recovered between the cumulative steam injection of 150 to 160 Mlbs. However, the rate of mass recovery, illustrated by the slope of the red line, is similar in value before and after the jump in mass recovery. The data do not indicate a significant decay in recovery rate after breakthrough. Similarly, the NAPL recovery alone is also plotted as a function of cumulative steam injected instead of date. The NAPL recovery rate remains relatively steady from 160 million pounds of steam and beyond.



***Response**: The total mass recovery rate has decreased over time since peaking in mid-May 2015 at a rate above 22,000 lbs/day. Mass removal rates have since decreased, but have remained relatively constant the past several months, albeit at varying recovery rates, influenced by the pressure cycling events. The total mass recovery rate has shifted from primarily being comprised of NAPL recovery prior to the peak, to primarily being comprised of mass removed as vapor (vapor and dissolved phase concentrations processed through the air strippers) post mass removal peak. As indicated in Table 4-2 of the RDRA WP, mass contribution from outside the TTZ may mask the progress of mass removal within the TTZs, so the contribution of perimeter/interior extraction wells is being evaluated to identify the extent to which perimeter influx is contributing to the mass removal rate. Based on information presented in the December BCT teleconference, total mass removal is less than 20% of the peak and is approaching the 10% target. A recent coordinated depressurization event in all three zones beginning 28 December 2015 resulted in an increase in LNAPL recovery and pushed overall mass removal rates up to 405 of the peak..*

From Nov. 2015 reports (comments 3 and 4):

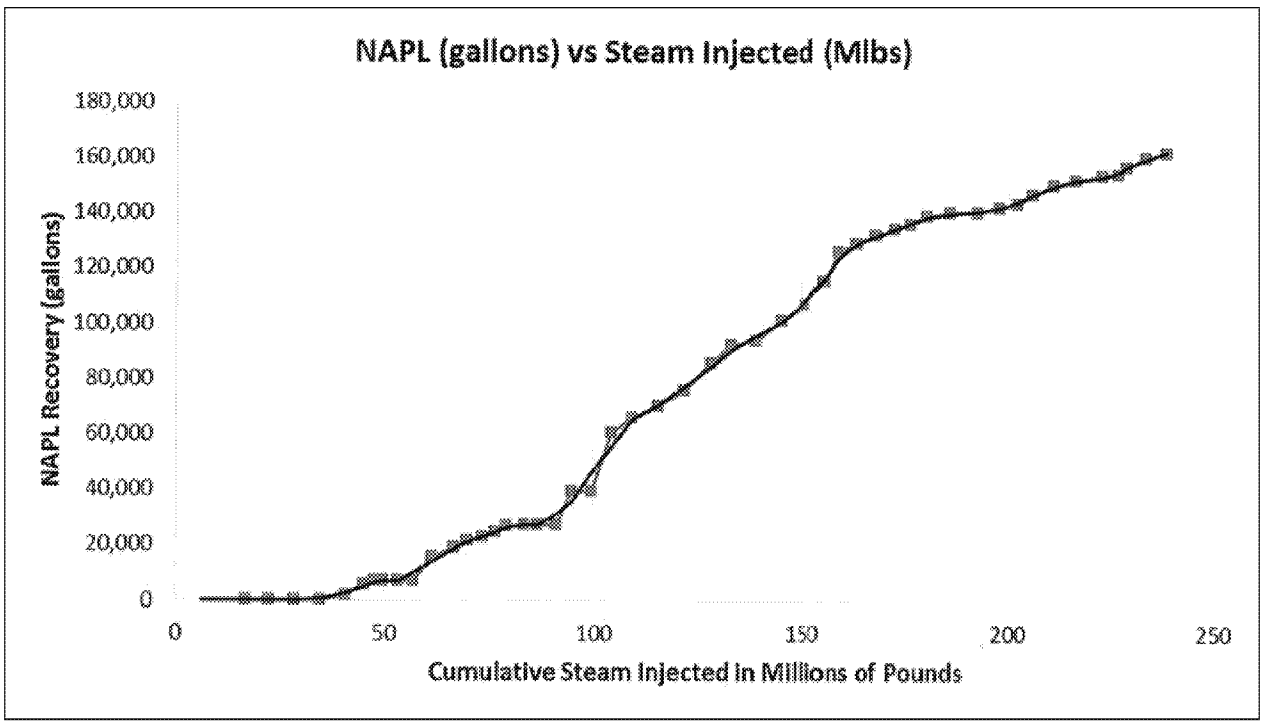
The reported mass removal rate 3,800 gallons for the week does not appear to have significantly decreased. Consider the reported 0 gallons of NAPL recovery, but the equivalent vapor treatment recovery.

***Response**: Overall mass removal is calculated as the sum of mass removed as NAPL and mass removed in the vapor phase. The NAPL extracted with the water from the wellfield is separated from the liquid stream in the front end of the liquid treatment system, conditioned and then sent to the NAPL storage tanks. The NAPL volume (gallons) is recorded by a NAPL flow meter and*

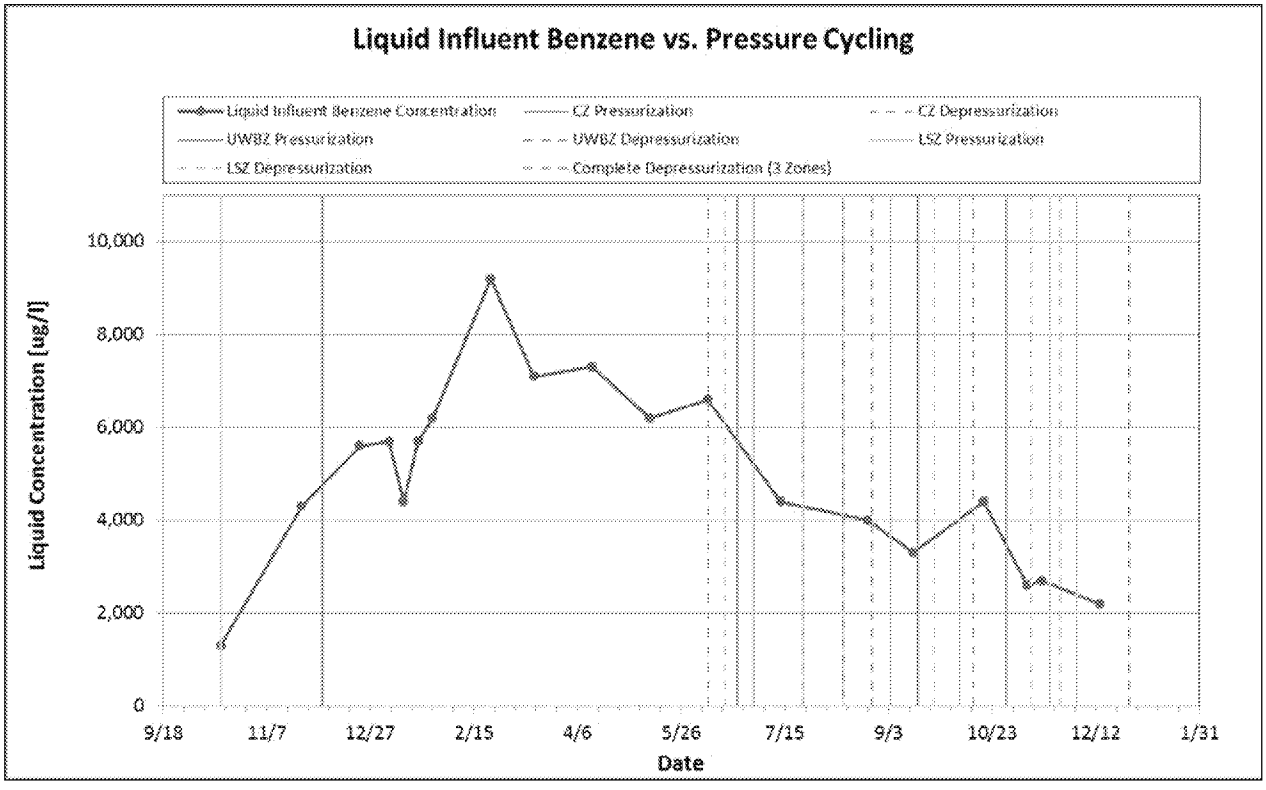
the mass is then calculated using a NAPL density of 6.57 lbs/gallon. The vapor mass removal is quantified by measuring the concentrations at the influent to the thermal accelerators (both based on PID and laboratory samples) and multiplying the concentration by the flow of vapor treated. The vapor contribution is coming from the vapors extracted from the wellfield combined with the effluents from the air strippers. The air stripper vapors are providing the majority of the total mass removed in the vapor phase.

We agree that the overall mass removal rate has been relatively consistent but that the source of the mass has been shifting until the recent coordinated depressurization from NAPL to vapor. During the recent coordinated depressurization event NAPL recovery has increased, likely due to the larger inward gradients established than during previous operations. These larger gradients may be pulling NAPL into the TTZs. Vapor mass recovery has also decreased during the coordinated depressurization likely due to at least partial collapse of the steam bubble. These conditions are expected to reverse once the site is re-pressurized.

The data do not show a benzene decrease in the extracted groundwater. Consider the benzene in the feedwater to the eductor pumps should be going down since the water is continually recirculated.



Response: *The dissolved phase benzene feedwater concentrations detected over time are shown in the figure below, represented by the air stripper influent benzene concentrations. As seen in the figure below, the dissolved phase benzene concentrations have declined from the peak benzene concentration observed in late February 2015.*



Please contact me at (602) 733-6040 or Catherine Jerrard at (315) 356-0810, ext. 204 or catherine.jerrard@us.af.mil, if you have any questions regarding the responses provided.

Sincerely,
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